

# Clemson IPM Program Newsletter

June 2021

Issue #2

Integrated pest management is an ecologically-based approach to managing pests with an emphasis on using multiple management strategies. The principles of IPM can be applied to any pest of food or fiber production systems, landscapes, and urban environments. IPM considers multiple control tactics with the aim of minimizing selection pressure on one given tactic.

The Clemson IPM program (<https://www.clemson.edu/extension/ipm/index.html>) seeks to increase adoption of IPM practices in South Carolina by developing interdisciplinary, research based information, and providing it to the public in efficient and accessible formats. The goals of the IPM program are driven by the needs of stakeholders, who have an integral part in developing the priorities of the current program.

This is the first edition of The Clemson IPM Newsletter which will provide updates on research, extension programs, successes in IPM, important dates, and more!



@IPM\_Clemson

Follow the Clemson IPM program on Twitter for real time updates throughout the growing season

## Meet the Team

### Pee Dee REC

Francis Reay-Jones, *Field Crop Entomology*

JC Chong, *Specialty Crop Entomology*

Joe Roberts, *Turfgrass Pathology*

Ben Powell, *Pollinator Specialist*

### Coastal REC

Tony Keinath, *Vegetable Pathology*

Matt Cutulle, *Vegetable Weeds*

Brian Ward, *Organic Vegetable*

The IPM program at Clemson is comprised of the coordination team, extension personnel, and researchers throughout the state;

### Edisto REC

Jeremy Greene, *Field Crop Entomology*

Mike Marshall, *Field Crop Weeds*

Dan Anco, *Peanut Specialist*

John Mueller, *Field Crop Pathology*

### Clemson Main Campus

Guido Schnabel, *Fruit Crop Pathology*

Juan Carlos Melgar, *Pomology*

Steve Jeffers, *Specialty Crop Pathology*

### UGA, Athens

Brett Blaauw, *Peach Entomologist*

### Coordination Team

Program Coordinator

Francis Reay-Jones

Associate Program Coordinator

Tim Bryant

## Tell us what you think...

Please take a few minutes to fill out this [survey](#) to tell us what you would like to see in future editions of this newsletter!

Partial support for the Clemson IPM Program is provided by funding from the USDA NIFA Crop Protection and Pest Management Extension Implementation Program.

# Downy Mildew Management in Cucumbers

Fungicide programs for downy mildew management in cucumber assessed for their economic value.

In South Carolina, one of the most common diseases which infects and damages slicing cucumbers is downy mildew. Downy mildew affects the leaves as chlorotic and necrotic spots on the upper surface, ultimately leading to a reduction in photosynthesis which can interfere with the development of cucumbers. Downy mildew does not successfully overwinter in South Carolina but is spread from more southern states via wind-blown spores each year. It can travel up to 600 miles in two days allowing it to spread readily. Effective management of this common disease relies on integrated management through all available strategies.

At the Coastal Research and Education Center in Charleston, SC, Dr. Tony Keinath, a vegetable pathologist, and Dr. Felipe Silva, an agricultural economist, are finalizing the results of their 2020 research assessing the economic value of various management strategies for downy mildew management. Their primary goals in these studies were to 1) determine how much yield and subsequent profit loss occur in cucumber as a

result of downy mildew, and 2) test different fungicides for reduced efficacy due to resistance development and the economic impact of choosing a less effective fungicide.

The fungicides tested included Bravo, a common broad-spectrum fungicide, and a combination of Bravo rotated weekly with each of another four commercial fungicide formulations including Previcur Flex, Curzate, Presidio, and Orondis Opti. Fungicides varied in cost for the season (7 sprays) from ~\$62 for Bravo alone to ~\$276 for the most expensive fungicide, Orondis Opti.

Relative to control plots, sprayed with no fungicides, or plots sprayed bi-weekly with Bravo only, any of the spray programs described above increased profits by 58%. In these experiments this was the equivalent of an extra 160 cartons of marketable cucumbers per acre or around \$2500 per acre. While more effective fungicides typically cost the grower more, the level of yield loss seen from downy mildew in these experiments justified the cost of fungicide.



*Symptoms of downy mildew on cucumber. Note the angular chlorotic spots on the upper surface of the leaf.*

While all the fungicides listed above provided control in these experiments, Dr. Keinath does not recommend using Curzate due to its relatively poor performance and the development of resistance in some downy mildew isolates. Orondis Opti, Presidio, and Previcur Flex are all effective, but the price of these materials should be considered when making a selection. Orondis Opti is the most expensive material and no longer provides the best control, so it should be rotated with...cont. page 3



*Downy mildew symptoms on control plots, treated with no fungicide (left), and a healthy plot treated with a weekly rotation of Presidio and Bravo (right).*



another fungicide to reduce costs and maximize control. Note that resistance to Presidio and Previcur Flex also occurs, so if these fungicides are used, they must be rotated with another more effective fungicide (<https://lgpress.clemson.edu/publication/cucurbit-downy-mildew-management/>). While choosing the correct fungicide is an important part of managing this disease, it is only a single strategy which should be used in conjunction with all other available strategies to improve overall

control. One of these additional strategies is selecting a vigorous slicing cucumber hybrid with some level of resistance to downy mildew. While a number of fungicide applications may still be needed to prevent losses completely, choosing a tolerant hybrid can improve control provided by those applications. Making these management decisions with consideration for all available strategies is the cornerstone of successful integrated pest management programs.

This project was supported by the USDA, NIFA, and Southern IPM Center.

## Weed Suppression Using Cover Crops

Cover crops can be an important part of integrated management of weeds in field crops

The over-reliance on one form of weed control has resulted in the selection of weeds resistant to herbicides. Glyphosate, a non-selective broad-spectrum herbicide, has been the dominate weed management tool in glyphosate-tolerant corn, soybean, and cotton. Postemergence only glyphosate programs simplified weed control but resulted in a system dominated by one mode-of-action across millions of crop acres. It replaced important practices including rotating herbicide modes-of-action and use of soil residual herbicides. In 2005,

Palmer amaranth was confirmed resistant to glyphosate in Georgia (less than a decade after the introduction of glyphosate-tolerant crops). Palmer amaranth resistance has since spread across the South and Midwest crop producing regions of the United States. In South Carolina, Palmer amaranth is resistant to several herbicide families including glyphosate (group 9), ALS-inhibitors (group 2), and DNA-inhibitors (group 3). Other states have reported Palmer amaranth populations resistant to glufosinate (group 10), triazines



*Glyphosate-resistant Palmer amaranth infestation in soybean*

(group 5), synthetic auxins (group 4), PPO-inhibitors (group 14), and HPPD inhibitors (group 27).

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*(Left) Rye cover crop planted in the fall and (Right) terminated and rolled rye cover crop after cotton planting*





*(Left) Postemergence glyphosate based only herbicide system in cotton with no cover crop and (Right) cotton planted into a terminated cover crop and use of multiple herbicide modes-of-action and residuals during the season.*

Cultural practices, such as cover crops, can suppress weed emergence through shading of the soil surface and reduce reliance on herbicides. The key is to select a cover crop species that produces a high biomass by the time of termination. Cereal rye is a winter planted cover crop that can produce high levels of biomass (several tons per acre). Biomass production is dependent on the planting date with the earlier planted rye (October-November) yield higher than later planted rye (December-January).

Some weed species require a light cue for germination. Typically, small-seeded weeds like Palmer amaranth and large crabgrass will not germinate if the soil surface is

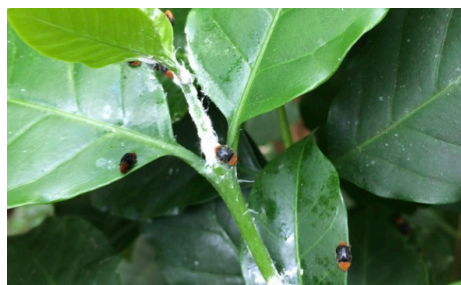
covered by a thick layer of biomass from the terminated cover crop. If some seeds manage to germinate, the incidence of the weed populations will be significantly reduced compared to a bare-ground soil surface.

Studies have been conducted over the past several years by Dr. Mike Marshall, field crop weed specialist at the Edisto Research and Education Center, focusing on using cover crops as part of the overall weed management plan. Results from the trials showed that cover crops significantly reduced Palmer amaranth germination and subsequent populations in cotton. In addition to the cover crops, a diverse herbicide program was also used that includ-

ed multiple modes-of-action and the use of soil residual herbicides at planting and with every postemergence application (overlapping residuals).

Cover crops are an important cultural practice in managing weeds in field crops. With herbicide resistance a growing concern, these cover crops can help reduce the selection pressure on the herbicides that still work. Preserving herbicide effectiveness is critical because the crop protection industry is not producing new herbicide modes-of-action every year for growers to use when an herbicide fails on a given weed species, especially Palmer amaranth.

## Land-Grant Press IPM Spotlight



**Biological Control Strategies  
in Integrated Pest  
Management (IPM) Programs**  
May 16, 2021 | Agriculture, Horticulture

Extension agent Andrew Jeffers and Dr. JC Chong wrote this article describing different methods of biological control and its use in an effective IPM Program. Check it out at the following link!

<https://lgpress.clemson.edu/publication/biological-control-strategies-in-integrated-pest-management-ipm-programs/>

# Efficacy of Insecticides for Diamond-back Moth Caterpillars in Brassicas

Monitoring insecticide resistance is a critical step in providing producers with up to date insecticide efficacy data specific to them.

Brassica crops are quickly progressing and being harvested in South Carolina. As these crops mature, the number one pest issue for growers to be concerned about is the diamondback moth (DBM) caterpillar. These caterpillars are small, rapidly reproducing pests which can occur in large numbers if unchecked by growers causing a significant level of injury. Chewing on the leaves can cause significant defoliation, and a large infestation will leave behind frass and pieces of the pupae and larvae, reducing the quality of the crop.

The primary means of controlling these pests are through insecticide applications, however repeated use of the same materials throughout a season and over several years can lead to the development of insecticide resistance. The development of insecticide resistance ultimately will cost growers more in the form of additional sprays or applying more expensive materials.

Clemson Extension Agent, Justin Ballew, is working to identify the most effective insecticides to help delay the development of resistance in DBM populations and keep commercial brassica producers informed on which insecticides work best. To do this, DBM caterpillars are collected from the field in various locations and an insecticide bioassay is performed.

Brassica leaves are dipped in various insecticides labeled for DBM

management and placed in a cup with 10 caterpillars. Each cup is then evaluated every 24 hours for a total of 3 days to determine the number of living, dead, and pupated caterpillars. Based on the results of these bioassays a report can be generated that provides growers in a localized area a ranking of effective insecticides. “This is a free service we are providing to growers” Ballew says, “anyone that is interested in having a bioassay performed in their field should just contact one of the Extension Fruit and Vegetable Agents”. An example of a report a grower may receive from this program is provided here.

	Dead	Live	Pupae	Total
Radiant	9	1		10
Proclaim	10			10
Dipel	7	2	1	10
Xentari	8	1		9
Avaunt	8	1	1	10
Coragen	3	3	3	9
Torac	10			10
Harvanta	8	1	1	10
BoteGHA	9			9
Control	5	4	1	10

*Example report from a DBM insecticide bioassay.*

All the tested products provided good control and can come from a wide range of mode of actions including Bt, spinosyns, oxadiazines, and diamides. Applying products from different modes of action is a primary strategy in delaying the development of resistance. While in this example all the products provided good control, efficacy of these products can vary greatly by location so producers should base their management plan on a bioas-



*Top: Diamondback moth caterpillar, Bottom: Diamondback moth control failure*

say specific to their field.

Another important consideration when applying insecticides for DBM is the potential for non-target effects on beneficial insects that could potentially aid in DBM control. There are a number of parasitoid species as well as predators that are naturally found in the field and can help to reduce overall DBM populations. Eliminating these natural enemies can also flare secondary outbreaks of spider mites or aphids in some cases as well. *Bacillus thuringiensis* (Bt) insecticides (Xentari or Dipel) for example, are an excellent option for promoting healthy populations of biological control agents by being selective for the target pest only (and other Lepidopteran immatures), and provided good DBM control in the experiments described here. Selecting an insecticide that is both effective for your target pest and minimizes unintended effects is a primary strategy in a successful IPM Program.